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*Article*

# Assessment of Knowledge Among Cardiac Nurses Regarding Patient Safety Post-Cardiac Catheterization

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## ABSTRACT

**Background**: Cardiovascular diseases remain the leading cause of mortality globally, with cardiac catheterization serving as a critical diagnostic and therapeutic procedure. Despite its widespread use, post-procedural complications can significantly impact patient outcomes if not promptly identified and managed. A research gap exists in understanding the preparedness of nursing staff in ensuring patient safety post-catheterization, especially in low- and middle-income settings. **Objective**: This study aimed to assess the knowledge of registered cardiac nurses regarding patient safety following cardiac catheterization, focusing on complication recognition, monitoring protocols, and preventive care practices, with the goal of identifying gaps and informing educational interventions. **Methods**: A descriptive cross-sectional study was conducted at the Peshawar Institute of Cardiology involving 152 registered nurses selected through convenience sampling. Inclusion criteria encompassed active cardiac care nurses, while those not involved in direct post-catheterization care were excluded. Data were collected using a validated structured questionnaire comprising 19 knowledge-based items. Ethical approval was granted by the institutional board in accordance with the Declaration of Helsinki. Data were analyzed using SPSS version 23, employing descriptive statistics and chi-square tests to examine associations between knowledge levels and demographic variables. **Results**: The mean age of participants was 29.34 years; 75.7% were male. Of the total, 82% demonstrated satisfactory knowledge. Correct response rates were highest for head positioning (90.1%) and complication awareness (90.1%), while the lowest were for pseudoaneurysm detection (21.1%) and renal complication identification (27.0%). Statistically significant associations were observed between knowledge level and specialized training ($p < 0.001$), as well as certification ($p < 0.001$), while gender differences were not significant ($p = 0.148$). **Conclusion**: While overall nurse knowledge was satisfactory, critical deficits in detecting vascular and renal complications persist. Targeted training, role-based certification, and continuous professional development are essential to improving patient safety post-cardiac catheterization. These findings emphasize the need for systemic competency reinforcement to enhance cardiovascular care outcomes.

**Keywords**: Cardiac Catheterization, Patient Safety, Nursing Knowledge, Postoperative Care, Vascular Complications, Renal Insufficiency, Professional Training

## INTRODUCTION

Cardiovascular diseases (CVDs) represent the foremost cause of mortality globally, accounting for an estimated 17.9 million deaths in 2019, which comprised approximately 32% of all global fatalities (2). Among these, coronary artery disease (CAD) stands out, responsible for about 85% of CVD-related deaths due to myocardial infarction and stroke (2). In Pakistan, CAD contributes to nearly 9.87% of all deaths, with a significant annual toll nearing 200,000 lives, translating to an average of 12 cardiovascular deaths every hour (6). This growing burden is particularly critical in low- and middle-income countries (LMICs), where over 4.5 million CAD-related

deaths occur annually due to limited resources and infrastructure (7,12).

Several modifiable risk factors underlie this disease burden, including tobacco use (9%), hypertension (13%), diabetes (6%), physical inactivity (6%), and obesity (5%) (3). Additionally, untreated streptococcal infections contribute to rheumatic heart disease, further compounding cardiac risk in endemic regions (3). These realities underscore the importance of preventive strategies, early diagnosis, and timely interventions for improved outcomes.

Cardiac catheterization remains a pivotal diagnostic and therapeutic tool for managing ischemic heart diseases. Despite its clinical utility, it carries risks ranging from minor adverse reactions—such as allergic responses to contrast media—to severe complications including thrombosis, pseudoaneurysms, arrhythmias, hematoma formation, renal impairment, and myocardial infarction (8,9). Literature reports complication rates between 1.5% and 9%, depending on procedural factors, vascular access technique, anticoagulation, and patient comorbidities (8). Notably, a study from Nepal reported a mortality rate of 0.84% and a 1.4% vascular compromise rate linked to catheterization (9).

The critical nature of post-procedural care necessitates that nurses possess comprehensive knowledge of potential complications and their early signs. However, emerging evidence suggests significant gaps in this area. A study by Elsayad et al. demonstrated that many nurses lack the knowledge required to identify signs of post-catheterization complications, administer appropriate interventions, and ensure safe patient recovery (10). Similar findings have been reported across various healthcare systems, including Iraq and Egypt, where knowledge deficits among nursing staff were associated with compromised patient safety (11,14).

In the Pakistani context, particularly at high-volume tertiary care centers such as the Peshawar Institute of Cardiology, the role of nursing staff is central to monitoring post-catheterization outcomes. Hence, assessing nurses' knowledge and preparedness is crucial to minimize risks and improve healthcare delivery. This study was designed to evaluate the knowledge of registered nurses regarding patient safety after cardiac catheterization, identify key knowledge gaps, and propose evidence-based recommendations for targeted educational interventions and professional development.

## MATERIALS AND METHODS

This descriptive cross-sectional study was conducted at the Peshawar Institute of Cardiology, a tertiary care facility located in Phase 5, Hayatabad, Peshawar. The aim was to assess the knowledge of registered nurses regarding patient safety following cardiac catheterization. Data collection spanned six months and targeted nursing professionals actively working in the cardiac care units of the hospital.

The total population of registered nurses at the institute was approximately 250. From this pool, a sample of 152 nurses was selected using a non-probability convenience sampling technique, with inclusion contingent upon voluntary participation and informed consent. All selected participants were registered nurses providing direct patient care in cardiac units. A structured, self-administered questionnaire comprising multiple-choice items was utilized as the primary data collection tool. The questionnaire was developed based on a review of relevant literature and existing clinical guidelines concerning post-cardiac catheterization care. It included demographic variables and 19 knowledge-based questions related to local and systemic complications, clinical monitoring, hemostatic measures, and safety precautions after catheterization.

The questionnaire was pre-tested for clarity and content validity prior to full-scale administration. Each correct response was scored as '1' and incorrect responses as '0'. The total knowledge score for each participant was computed by summing the individual item scores. A cut-off point of 60% was applied to differentiate between 'satisfactory' and 'unsatisfactory' knowledge levels.

Data analysis was performed using the Statistical Package for the Social Sciences (SPSS), version 23. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were calculated to summarize demographic data and knowledge scores. The findings were presented in tabular and graphical formats to illustrate response patterns and knowledge distributions. Ethical approval for the study was obtained from the relevant institutional review board. Participant confidentiality was maintained throughout the research process, and data were anonymized prior to analysis to ensure privacy and compliance with ethical research practices.

## RESULTS

A total of 152 registered nurses participated in the study, yielding a complete response rate of 100%. The demographic characteristics of participants are summarized in Table 1. Among the respondents, 115 (75.7%) were male and 37 (24.3%) were female. The mean age was 29.34 years, with the majority (65.1%) between 20 and 29 years old, and the remaining 34.9% aged between 30 and 39 years. None of the participants were above 40 years of age.

Professional qualifications and training backgrounds were notable. A significant proportion (90.8%) of nurses reported possessing certifications related to cardiac care. Similarly, 132 participants (86.8%) had received specialized training in cardiac units, and 129 (84.9%) had attended workshops or training sessions related to post-cardiac catheterization safety within the past year. In terms of work experience, 65.1% had 1–3 years of experience in cardiac care, while 19.1% had 4–7 years, 5.9% had over 8 years, and 9.9% had less than 1 year.

The knowledge assessment comprised 19 questions covering various domains of post-cardiac catheterization care, including recognition of complications, patient monitoring, and procedural safety. The overall correct response rate was 67.73%, while 32.27% of responses were incorrect. Based on the pre-defined cutoff (≥60% considered satisfactory), 124 participants (82%) demonstrated satisfactory knowledge, and 28 (18%) had unsatisfactory scores. Table 2 presents the detailed distribution of correct and incorrect responses per item. High performance was noted on questions regarding the proper head position after

the procedure (90.1% correct), identification of important complications (90.1%), assessment of the accessed extremity (88.2%), and knowledge of local complications (87.5%). The lowest scoring item was detection of pseudoaneurysm (21.1% correct). Other challenging areas included hematoma management (27.0%), understanding renal complications (27.0%), and guidance on sexual activity restriction post-procedure (32.2%).

**Table 1. Demographic and Institutional Characteristics of Participants**

| Variable | Count | Percentage (%) |
|---|---|---|
| **Gender – Male** | 115 | 75.7% |
| **Gender – Female** | 37 | 24.3% |
| **Age 20–29** | 99 | 65.1% |
| **Age 30–39** | 53 | 34.9% |
| **Age 40 and above** | 0 | 0.0% |
| **Cardiac Unit Certification – Yes** | 138 | 90.8% |
| **Cardiac Unit Certification – No** | 14 | 9.2% |
| **Specialized Training in Cardiac Unit – Yes** | 132 | 86.8% |
| **Specialized Training in Cardiac Unit – No** | 20 | 13.2% |
| **Experience Less than 1 Year** | 15 | 9.9% |
| **Experience 1–3 Years** | 99 | 65.1% |
| **Experience 4–7 Years** | 29 | 19.1% |
| **Experience 8 Years and Above** | 9 | 5.9% |
| **Attended Workshop on Post-Catheterization Safety – Yes** | 129 | 84.9% |
| **Attended Workshop – No** | 23 | 15.1% |

**Table 2. Nurse Knowledge Responses on Post-Cardiac Catheterization Safety Items**

| Knowledge Item | Correct (%) | Incorrect (%) |
|---|---|---|
| **Local complications after cardiac catheterization** | 87.5 | 12.5 |
| **Detection of pseudoaneurysm** | 21.1 | 78.9 |
| **Timing of serum creatinine check** | 74.3 | 25.7 |
| **Complication of delayed sheath removal** | 76.3 | 23.7 |
| **Development of contrast-induced nephropathy** | 61.8 | 38.2 |
| **Risk of renal failure** | 45.4 | 54.6 |
| **Sign of thrombus formation** | 76.3 | 23.7 |
| **Immobilization of affected extremity** | 76.3 | 23.7 |
| **Risk of pulmonary edema** | 77.0 | 23.0 |
| **Management of hematoma at puncture site** | 27.0 | 73.0 |
| **Hemostasis after sheath removal** | 80.9 | 19.1 |
| **Positioning of head post-procedure** | 90.1 | 9.9 |
| **Assessment of accessed extremity** | 88.2 | 11.8 |
| **Important complications of cardiac catheterization** | 90.1 | 9.9 |
| **Cause of renal complications during angiography** | 27.0 | 73.0 |
| **Cause of pseudoaneurysm** | 87.5 | 12.5 |
| **Duration of sexual activity restriction** | 32.2 | 67.8 |
| **Definition of hematoma** | 84.2 | 15.8 |
| **Action if incision bleeds at home** | 83.6 | 16.4 |

To identify associations between knowledge levels and key demographic factors, chi-square tests were conducted. As shown in Table 3, the association between specialized training and satisfactory knowledge was highly significant ($p < 0.001$), as was the relationship between cardiac care certification and knowledge level ($p < 0.001$). The association between years of experience and knowledge approached statistical significance ($p = 0.055$), indicating a possible trend worth further investigation. However, the difference in knowledge levels between male and female participants was not statistically significant ($p = 0.148$).

**Table 3. Chi-square Test Results for Demographic Variables vs. Knowledge Level**

| Variable | Chi-square p-value |
|---|---|
| **Gender vs. Knowledge Level** | 0.148 |
| **Cardiac Certification vs. Knowledge Level** | 0.00037 |
| **Specialized Training vs. Knowledge Level** | 0.0000006 |
| **Years of Experience vs. Knowledge Level** | 0.055 |

These results confirm that certification and specialized training are critical predictors of knowledge competency among nurses managing post-cardiac catheterization care.

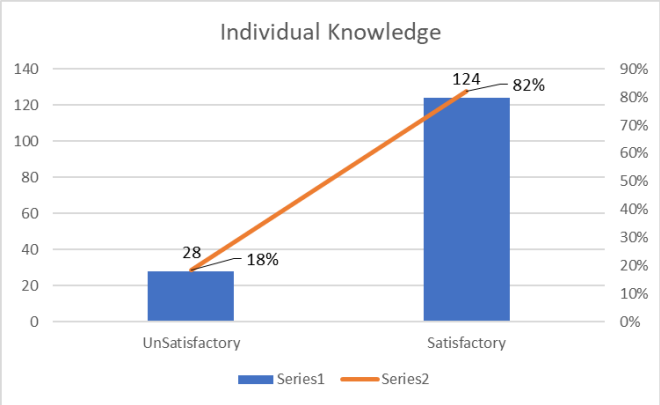


**Figure 1 Knowledge Level**

The lack of statistical significance for gender suggests that observed differences may be incidental and not necessarily indicative of systematic disparities.

## DISCUSSION

The present study aimed to assess the knowledge of registered nurses regarding patient safety following cardiac catheterization, an area of critical importance given the high global burden of cardiovascular diseases and the invasive nature of catheterization procedures. Findings revealed that the majority of nurses (82%) demonstrated satisfactory knowledge, with an overall correct response rate of 67.73%. These results indicate a reasonable baseline level of awareness; however, notable gaps were observed in areas such as detection of pseudoaneurysms, identification of renal complications, and post-procedural restrictions, underscoring the need for targeted educational interventions.

The study's findings are consistent with data reported from Punjab Institute of Cardiology, where 74.27% of nurses showed good knowledge of post-catheterization complications (13). Similarly, Elsayad et al. in Egypt found that 57.6% of nurses demonstrated adequate knowledge while 42.4% had suboptimal understanding, indicating persistent variability in training and competency across institutions (5). In contrast, a study conducted at Kirkuk University, Iraq, revealed an alarmingly low average correct response rate of only 23.41%, with the majority of items answered incorrectly by more than half of the respondents (14). This stark difference may reflect systemic disparities in nurse training, clinical role clarity, and access to continuing education across healthcare systems. Countries like Pakistan and Egypt, where structured roles and continuous professional development programs are relatively more accessible, tend to report better nurse performance in clinical knowledge assessments.

The current study adds further evidence to the hypothesis that specialized training, certification, and clinical exposure are pivotal determinants of nursing competency in high-risk procedural care. Chi-square analysis confirmed significant associations between satisfactory knowledge and both cardiac certification ($p < 0.001$) and specialized training ($p < 0.001$), affirming the theoretical framework that competency is reinforced through formal learning and hands-on experience. Although the association between years of experience and knowledge approached statistical significance ($p = 0.055$), it may not have reached the threshold due to the relatively small subgroup sizes within each experience bracket, warranting a larger sample for confirmation. Interestingly, while male nurses appeared to outperform their female counterparts descriptively, the difference was not statistically significant ($p = 0.148$), suggesting that gender may not be an independent predictor of knowledge once professional variables are accounted for.

Mechanistically, the gaps identified in the knowledge domains—especially in recognizing vascular complications like pseudoaneurysms—may stem from limitations in bedside exposure or a lack of simulation-based training for rare but high-risk scenarios. The inadequate recognition of renal complications and post-procedure activity guidelines may also reflect insufficient emphasis on multidisciplinary communication, particularly with nephrology and rehabilitation services, which are crucial post-intervention allies. These deficiencies carry significant clinical implications, as unrecognized complications after cardiac catheterization can lead to increased morbidity, longer hospital stays, and elevated healthcare costs. Therefore, improving nursing knowledge is not merely an academic pursuit but a clinical imperative.

One of the strengths of this study lies in its institutional focus, which allowed for a concentrated evaluation within a well-defined cardiac care environment, ensuring uniformity in procedural context. The 100% response rate further strengthens the internal validity. However, the use of convenience sampling, single-center design, and moderate sample size (n=152) limit the generalizability of findings. The reliance on self-reported questionnaire data may also introduce response bias, as actual clinical performance was not observed or verified.

Future research should involve multicenter studies with larger and more diverse samples to validate these findings and explore regional variations. Longitudinal designs are also recommended to assess the impact of continuous professional development and targeted workshops on knowledge retention and clinical outcomes. Incorporating simulation-based learning assessments could provide more dynamic and accurate evaluations of nursing competencies. Moreover, studies should examine the efficacy of interprofessional training programs in bridging knowledge gaps, especially in areas like renal risk mitigation and post-catheterization rehabilitation planning.

In conclusion, while the majority of nurses at the Peshawar Institute of Cardiology exhibited satisfactory knowledge regarding post-cardiac catheterization safety, critical knowledge gaps persist, particularly in identifying and managing less common but clinically significant complications. Certification, specialized training, and experience are positively associated with knowledge proficiency, affirming their role in clinical competency development. Addressing these gaps through targeted educational strategies and system-level interventions is essential to enhance patient safety and improve cardiovascular care outcomes in Pakistan and similar healthcare settings.

## CONCLUSION

This study assessed the knowledge of cardiac nurses regarding patient safety following cardiac catheterization and found that while the majority demonstrated satisfactory knowledge (82%), critical gaps remain in recognizing specific complications such as pseudoaneurysm formation, renal impairment, and post-procedural care guidelines. These findings highlight the essential role of specialized training, certification, and clinical experience in enhancing nursing competency in high-risk cardiovascular interventions. Addressing these knowledge deficits through structured educational programs and continuous professional development is vital to improving patient outcomes and ensuring safer post-catheterization care. Clinically, this underscores the need for hospital administrations to invest in competency-based training models, while future research should explore longitudinal impacts of such interventions on both nurse performance and patient safety metrics in cardiac care settings.

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